THE INVENTION CLAIMED IS:

1. A frequency converter for shifting the frequency of an input signal by a desired frequency, the frequency converter comprising:

   (a) first oscillator means for producing a first signal at a first frequency;

   (b) second oscillator means for producing a second signal at a second frequency;

   (c) frequency conversion means for converting the frequency of the input signal equal to a frequency difference of the first signal and the second signal; and

   (d) mixing means for mixing said first signal and said second signal to produce a frequency difference signal representative of the frequency difference between the first and second signals; and

   (e) sampling means for sampling the frequency difference signal with a synthesized reference signal such that aliasing results in an error signal corresponding to a frequency difference between the difference signal and a desired frequency shift;

   (f) one of said first oscillator means and second oscillator means being responsive to the error signal to adjust the frequency of the first signal and second signal, respectively.

2. The frequency converter as claimed in claim 1, wherein said first oscillator means and said second oscillator means are each configured to receive an external reference frequency signal and derive the first signal and second signal, respectively, with reference to the external reference frequency signal, and the sampling means is configured to derive the synthesized reference signal from the external reference signal.

3. The frequency converter as claimed in claim 1, wherein said sampling means comprises a pulse train generator configured to receive an external reference frequency signal and generate, with reference to the external reference frequency signal, the synthesized reference signal, the synthesized reference signal having a harmonic at a frequency corresponding to the desired frequency shift.

4. The frequency converter as claimed in claim 3, wherein said pulse train generator comprises a direct digital synthesis circuit, a comparator for clipping the output of said direct digital synthesis circuit and a comb generator for converting the edges of the output of said comparator to delta pulses.

5. The frequency converter as claimed in claim 3, wherein said sampling means comprises a mixer for mixing said difference signal and said synthesized reference signal to produce said sampled signal.

6. The frequency converter as claimed in claim 1 wherein the input signal is a frequency shifted orthogonal frequency division multiplexed signal.

7. The frequency converter as claimed in claim 6 wherein the frequency converter is an upconverter for converting an input signal from an intermediate frequency to a higher frequency.

8. The frequency converter as claimed in claim 6 wherein the frequency converter is a downconverter for converting an input signal from a higher frequency to a lower intermediate frequency.

9. The frequency converter as claimed in claim 6 wherein the input signal is a digital television signal.

10. A frequency converter for shifting the frequency of an input signal by a desired frequency, and that receives an external reference frequency signal, the frequency converter comprising:

(a) a first oscillator that receives the external reference frequency

signal and that produces a first signal at a first frequency;

(b) a second oscillator, responsive to a error signal, that receives the external reference frequency signal and that produces a second signal at a second frequency, said input signal being shifted in frequency by the difference between said first frequency and said second frequency;

(c) a difference circuit, comprising a difference mixer and a difference low pass filter, said difference mixer receiving said first signal and said second signal and producing a mixed signal, and said difference low pass filter filtering said mixed signal to produce a difference signal;

(d) a pulse train generator that receives the external reference frequency signal and that generates a pulse train signal with a harmonic at the desired frequency; and

(e) a sampler circuit for receiving said pulse train signal and said difference signal to produce said error signal.

11. The frequency converter claimed in claim 10, wherein said first oscillator comprises a first local oscillator and a first frequency synthesizer connected in an oscillator loop and wherein said second oscillator comprises a second local oscillator and a second frequency synthesizer connected in an oscillator loop.

12. The frequency converter claimed in claim 11, wherein said second oscillator further comprises a switch connected to said second local oscillator for selecting as an input said second frequency synthesizer or said error signal.

13. The frequency converter claimed in claim 12, wherein said first oscillator shifts the frequency of said input signal upwards and outputs a shifted signal, and wherein said second oscillator shifts the frequency of said shifted signal downwards and outputs an output signal, said output

signal having a frequency higher than the frequency of said input signal by the desired frequency.

14. The frequency converter claimed in claim 12, wherein said first oscillator shifts the frequency of said input signal downwards and outputs a shifted signal, and wherein said second oscillator shifts the frequency of said shifted signal upwards and outputs an output signal, said output signal having a frequency lower than the frequency of said input signal by the desired frequency.

15. An transmitter for transmitting orthogonal frequency division modulated (OFDM) signals, comprising:

(a) an OFDM transmission engine configured to accept a digital input signal and modulate the input signal onto a plurality of orthogonal carriers to produce a baseband OFDM signal;

(b) an intermediate frequency converter configured to accept the baseband OFDM signal as input and shift it to an intermediate frequency signal; and

(c) an RF frequency upconverter for shifting the intermediate frequency (IF) signal by a desired frequency to an RF transmission frequency, including:

(i) a pair of frequency synthesizers for generating, based on an external frequency reference, signals having a frequency difference therebetween;

(ii) a converter for shifting the frequency of the IF signal by an amount corresponding to the frequency difference of the signals from the pair of frequency synthesizers;

(iii) a reference signal generator for generating, based on the external reference signal, an internal reference signal having a harmonic at a frequency corresponding to the desired frequency;

(iv) a sampler for sampling a frequency difference signal corresponding to the frequency difference of the signals from the pair of frequency synthesizers with the internal reference signal to produce an error signal corresponding to the difference between the frequency difference signal and the desired frequency;

(v) one of said frequency synthesizers being responsive to the error signal to adjust the frequency of the signal generated thereby to compensate for the difference between the frequency difference signal and the desired frequency.

16. The transmitter of claim 15, wherein said sampler comprises a mixer for generating said error signal from aliasing that results from the mixing of said frequency difference signal and said internal reference signal.

17. The transmitter of claim 16, wherein said reference signal generator includes a pulse train generator comprising a direct digital synthesis circuit, a comparator for clipping the output of said direct digital synthesis circuit and a comb generator for converting the edges of the output of said comparator to produce said internal reference signal as a pulse train signal.

18. A frequency conversion method, for shifting the frequency of an input signal by a desired frequency, comprising the steps of:

(a) generating a first signal at a first frequency;

(b) generating a second signal at a second frequency;

(c) mixing the input signal with said first signal to produce a shifted signal;

(d) mixing said shifted signal with said second signal to produce an output signal;

(e) mixing said first signal and said second signal to produce a difference signal;

(f) comparing said difference signal with a pulse train signal, said pulse train signal having a harmonic corresponding to the desired frequency, producing, through aliasing, a low frequency error signal corresponding to the difference between said difference signal and the harmonic of said pulse train signal; and

(g) adjusting the frequency of one of said first signal and said second said second signal in response to said error signal.

19. The method of claim 18 wherein said input signal is shifted by an amount equal to the frequency difference between the first signal and the second signal from an intermediate frequency to a higher RF transmission frequency.

20. The method of claim 18 wherein said input signal is shifted by an amount equal to the frequency difference between the first signal and the second signal from an RF transmission frequency to a lower intermediate frequency.